at 4 p. m., extended to Lake Ontario. The center of the disturbance moved slowly northeastward, but by the morning of the 22d the storm had almost lost its identity and appeared to be dissipating over northern Michigan. Verifying velocities were attained over extreme southern Lakes Michigan and Huron and over portions of Lakes Erie and Ontario. The remainder of the month was without any storm activity that required the issuance of warnings.—*C. A. Donnel.*

NEW ORLEANS FORECAST DISTRICT.

Small-craft warnings were displayed on the Texas and Louisiana coasts on the 12th for a disturbance of moderate intensity, which moved northeastward from the lower Rio Grande Valley and was attended by shifting winds which reached moderate gale force at times.

On the 19th a V-shaped trough of low pressure extended into west Texas and northern Mexico and was advancing eastward. Southeast storm warnings were ordered displayed on the Texas coast at 8:40 p. m. Winds of verifying velocity occurred during the night. Small-craft warnings were displayed on the Louisiana coast on the 20th and were justified.

Small-craft warnings, displayed on the Texas coast on the 23d, were justified.

On the 30th, with conditions generally similar to those of the 19th but with smaller barometric gradient, southeast storm warnings were ordered displayed on the Texas coast at 8:40 p. m. A 40-mile wind from the southeast was reported the next morning from Galveston, Tex.

Frost forecasts for the northern portion of the district, or some part thereof, were issued on the 5th, 7th, and 8th and were justified. Forecasts of frost, issued on the 14th 15th, and 24th, were not so successful, the temperatures not being quite low enough for frost.—*R. A. Dyke.*

DENVER FORECAST DISTRICT.

Low-pressure areas occupied some portion of the Denver Forecast District on 26 days during April. Four anticyclonic areas appeared on the northeastern slope of the Rocky Mountains during the month, and one of these, during the latter part of the month, persisted for nearly a week.

A moderate cold-wave warning was issued for extreme northeastern Colorado on the evening of the 5th, an anticyclonic area having appeared on the northeastern slope, with a sharp rise in pressure in western Montana and over the Dakotas. The temperature fell 28° at North Platte on the evening of the 6th and temperatures as low as 26° occurred along the eastern border of Colorado the following morning. On the morning of the 7th low-pressure areas of marked intensity were central in Iowa and southwestern Colorado, with moderately high barometric readings in Montana accompanied by temperatures ranging from 6° to 20° above zero. A cold wave occurred at Modena, without warnings, following the passage of a secondary depression over that locality. Freezing-temperature warnings were issued for Utah, Colorado, northern Arizona and northern New Mexico, with a moderate cold wave in central Colorado and possibly frost in southern Arizona. Freezing temperatures occurred throughout the area for which these warnings were issued, but the cold-wave warning for central Colorado was not verified as the HIGH moved southeastward to Kansas and the temperature fall in southern Arizona was not sufficient for the formation of frost. Low pressure prevailed on the southeastern slope on the morning of the 13th, with an extensive high-pressure area over the North Pacific states. Warnings of freezing temperature were issued for northeastern Arizona and frost or freezing temperatures for Colorado, Utah, and northern New Mexico. Frost or freezing temperatures occurred in the greater part of the area. The HIGH occupied the northern Rocky Mountain region and the eastern slope on the 14th and warnings of frost in northern and eastern New Mexico and local frost in Colorado were issued. Frost was reported in the greater part of the area, with frost temperatures as far south as the Mexican border. As the HIGH still occupied the Rocky Mountain region on the 15th local frost warnings were repeated for Colorado and northern New Mexico. Frosts were again reported in Colorado, but the development of a LOW in the Southwest was attended by cloudiness in New Mexico.

On the morning of the 20th low-pressure areas of marked intensity occupied Manitoba and the Texas Panhandle, with relatively high pressure in the middle Plateau region. Warnings of freezing temperature were issued for Colorado and New Mexico. Freezing temperature occurred in eastern Colorado and frost temperatures in parts of New Mexico. At 8 a. m. on the 22d a LOW of marked intensity was central in northeastern Arizona, with an anticyclonic area on the northeastern slope. Live-stock warnings were issued for Utah and northern and western Colorado, freezing-temperature warnings for northern New Mexico and northeastern Arizona and possibly frost in southern Arizona. Freezing temperatures occurred accompanied by heavy precipitation in parts of Colorado. Frost was reported at Phoenix, a temperature of 46° at Yuma and a killing frost at Santa Fe. Freezing-temperature and frost warnings were issued on the morning of the 23d for Colorado, New Mexico, Utah, and northern Arizona and frost in southern Arizona as the pressure was increasing throughout the district. Freezing temperature or frost prevailed, except in New Mexico, where cloudiness developed with rising temperature owing to relatively low pressure in southern Arizona. Frost or freezing-temperature warnings were repeated on the morning of the 24th for Colorado, Utah, and eastern New Mexico. Owing to the development of the southwestern LOW the temperature rose and freezing weather was reported only in localities in Utah and Colorado. On the morning of the 30th an area of low pressure of marked intensity, that had its inception in the Plateau region, was central in Colorado, followed by rising pressure in the Plateau region. Warnings of freezing temperature or frost were issued for eastern and southern Utah, freezing temperature in western Colorado, northern New Mexico, and northeastern Arizona, and possibly frost in southern Arizona. The warnings were justified, except in southern Arizona, where the fall in temperature was small owing to a slight barometric depression in southwestern Arizona.—*Frederick W. Brist.*

SAN FRANCISCO FORECAST DISTRICT.

Following a protracted dry spell in March, the month of April was ushered in with good rains that lasted intermittently till the 10th. Another rainy spell began began on the 17th and continued until the 21st, after which fair weather generally prevailed. The low-pressure areas causing the early rains came from the ocean;

while those causing the rains near the middle of the month were extensions of ocean storms combined with sudden new developments taking place over the land.

Frost warnings were issued for some one or more parts of the San Francisco Forecast District on 13 days and they were for the most part verified. Storm warnings were issued on the 2d, 4th, 17th, 18th, and 20th, the first three dates being for local storms between San Francisco and Eureka. That on the 18th was for expected local winds at Tatoosh Island, and those on the 20th were for a general storm along the North Pacific coast. Small-craft warnings were ordered at all North Pacific seaports on the 30th. It is believed all the storm warnings were justified and, in consequence, were of benefit to the marine interests.

Live-stock warnings were issued on the 16th for northern Nevada, Idaho, eastern Oregon, and eastern Washington. This was an especially good warning, as it was followed by a sudden and marked drop in temperature, and at the same time cold rains occurred at practically all of the places where the warnings where received. —*E. A Beals.*

RIVERS AND FLOODS.

By H. C. FRANKENFIELD, Meteorologist.

The most severe and destructive floods of the month occurred in New England, and particularly in Maine and New Hampshire. Much of the abnormal snowfall of the preceding winter remained in the northern woods, but the high temperatures of the closing days of the month caused it to melt rapidly and add its large increment to the run-off from the heavy rains of April 28 and 29 and the showers of April 30. The State of Maine suffered heavily, as will be seen in the report below by Mr. Edward P. Jones, meteorologist in charge of the Weather Bureau Office, Portland, Me:

The Maine flood owed its inception to the unprecedented snowfall of the past winter which, by reason of the unfrozen condition of the soil had caused the latter to become virtually saturated. The high temperatures of late April rapidly melted the large quantity of remaining snow, so that the accompanying heavy rains soon brought about a great flood. The absence of a sufficient number of storage basins was also a contributing factor, while another was that of the high tides that backed up the larger rivers at their mouths.

The flood extended over most of the State, and did the greatest damage along the Kennebec River, although it did not exceed that caused by the flood of December 16, 1901.

Extreme western Maine was free from serious flood conditions, while Aroostook County reported the worst flood on record.

The Moosehead storage prevented any great discharge from the east branch of the Kennebec, the flood flows coming almost entirely from Dead, Carrabassett, and Sandy Rivers, and becoming most severe at Fairfield, Waterville, Augusta, and Gardiner, although the entire Kennebec Valley suffered seriously.

The rivers began to rise April 28 and by night the Kennebec, Union, Machias, Penobscot, Piscataquis, and St. Croix were pressing against the dams and bridges along their courses. At 3 a. m. Sunday, April 29, the Kennebec overflowed its banks at Augusta and by 7 p. m. there was a 10-foot flow over the dam. The normal flow is about 3 feet.

The crest at Augusta was reached at 4 p. m. April 30 and the water fell below flood stage on Friday, May 4.

At Skowhegan the flow over the dam during the crest of the flood was 90,000 cubic feet per second, quite near the record established in 1901. At Gardiner the flood stage was reached at 2 a. m. April 29 and the crest stage at 3 a. m. May 1. The river fell below flood stage at 10 a. m. May 3.

The Androscoggin River has a fine storage basin near its source, but it drains a large area and the run-off when the snow commenced to melt caused the river to rise to danger point, eventually reaching the highest stage since the 1896 freshet.

The river at Rumford overflowed its banks April 29, reached the highest point April 30, and fell below flood stage at 10:30 p. m. May 3.

At Lewiston and Auburn the flood stage was reached at 10 a. m. April 29, the peak at 1 a. m. May 1, and the river fell below flood stage May 3. The highest registration of water flowing over the dam at 1 a. m. May 1 was 7 feet and 4½ inches.

The Penobscot is better controlled than any other river in Maine. If this river had been left to its own devices in the recent flood, as was the Kennebec, the city of Bangor would have been almost entirely overflowed. Only the Great Northern Paper Co. storage dams saved the city.

The rush of waters which smote Oldtown, Orono, and Bangor and other cities and towns in this region with such disastrous force came from the East Branch, the Seboeis River, and other streams in that territory tributary to the Penobscot. The dams there were inadequate to withstand the flood. Freshet alarm was sounded on the 28th and by 6 a. m., the 29th, the river at Oldtown, Orono, and Bangor reached flood stage.

Bangor was menaced as it had not been in 20 years by the waters of the Penobscot and the Kenduskeag, a tributary which flows through the business center of the city. The flood crest here occurred at 12:30 a. m. May 2, and the river fell below flood stage at 12:30 a. m. May 3.

At Dover and Foxcroft on the Piscataquis River the flood stage occurred April 28, crest on April 29, and the river did not fall below flood stage until May 8.

At Ellsworth on the Union River there were two flood crests one on April 30 and the other at 10 p. m. May 2, the latter due to the collapse of the large storage dam on the afternoon of the 2d.

High water levels were established all along the St. Croix and its tributaries.

At Fort Fairfield, on the Aroostook River, a tributary of the St. John, the flood stage occurred at 4 a. m. April 30, crest at 5 p. m. May 2, and the river did not fall below flood stage until May 5.

The following dams were swept out: Great Northern Paper Co's. dam at Lake Hoxie: Marshfield and East Machias dams, Milltown Bulkhead at North Anson, Hodgdon dam at Meduxnekeag, Ebeemee Pond dam, Katahdin Iron Works structure on Pleasant River, and the large dam at Ellsworth.

Activities in Aroostook County were paralyzed, its highways were under water, its transportation service suspended, and many families homeless. The waters were still at freshet height on May 2.

The losses, exclusive of those suffered by the railroads, were about $3,000,000, of which probably two-thirds was caused by the Penobscot River and its tributaries.

In the Merrimac Valley of New Hampshire and eastern Massachusetts there was less snow to melt than in Maine, but the rainfall was heavier. The river, however, did not rise above flood stage, except in localities, and the damage done was small.

The flood in the Connecticut River Valley was not so severe, as the total rainfall was somewhat less than in Maine and New Hampshire, and the amount of snow on the ground also less. The river reached a stage of 22 feet at White River Junction, Vt., at 2 p. m. April 30, or 9 feet above flood stage, and 20.4 feet at Hartford, Conn., at 2:30 p. m. May 2, or 4.4 feet above flood stage.

Flood warnings for the entire valley were issued on April 29 and 30. Not much damage occurred, although considerable inconvenience resulted in several places.

Earlier in the month there was another flood caused by fairly heavy rains in conjunction with the break-up of the ice. It was the usual spring freshet, and caused the usual minor damage to highways, railroads, etc. Unfortunately one death occurred at South Charlestown, N. H., where a hunter was drowned after the overturning of his canoe.

The crest stages of this flood were considerably lower than those of the late April and early May flood. The usual warnings were issued.

The same general conditions that attended the earlier Connecticut flood prevailed over the Hudson River drainage basin, but in less pronounced form, and the crest stages in the vicinity of Troy and Albany, N. Y., early on April 7, were from 2 to 5 feet above the flood stages. Warnings were issued on the morning of April 6, and were well verified by the subsequent occurrences. There were no losses of consequence.

In the extreme upper Susquehanna basin of New York there were some bankful stages, but without incident.

There were minor overflows in the rivers of North Carolina about the middle of the month which were ac-